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Occlusal Changes from Primary to Mixed Dentitions in Nigerian Children

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ABSTRACT

Objective: To evaluate longitudinally the occlusal changes between the deciduous and early mixed dentition stages in Nigerian children.

Materials and Methods: The occlusion of 145 3- to 5-year-old children was initially assessed at a popular pre-primary school center in Ibadan, Nigeria in October 2002, using the Foster and Hamilton criteria. The same group of children was followed up for reexamination in October 2006 in the primary school section of the center. Of 61 students who were located and reexamined, 54 (26 male and 28 female) qualified for the study. The molar relationship was assessed using Angle classification, and other occlusal features such as spacing, crowding, overbite, and overjet were also assessed. Descriptive statistics, chi-square test, as well as Pearson correlation coefficient, were applied as appropriate in the analysis of the data.

Results: Of 32 subjects initially having a flush terminal relationship (Class 1), 22 (68.7%) resulted in a Class I molar relationship, seven (21.9%) had Class II, and three (9.4%) had asymmetric relationships. Mesial step (Class III) was formed initially in 18 and 11 (61.1%) resulted in Class I. A Class III developed in five (27.8%). Significant positive correlations were found for molar relationship, crowding, overbite, and overjet variables ($P < .01$) between the two periods of assessments, but all were below 0.7 value.

Conclusions: Angle Class I molar relationship was favored by initial flush terminal plane and mesial step relationships in the deciduous dentition.

KEY WORDS: Occlusion, Growth, Development, Nigerian children.

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INTRODUCTION Return to TOC

The establishment and maintenance of normal occlusion constitute one of the important objectives of orthodontic treatment whether it is preventive, interceptive, or corrective.[1] Understandably, earlier reports on occlusal characteristics or patterns in Nigerian population involved only the permanent dentition.[2–6] However, the status of the primary dentition affects the development of the permanent occlusion to the extent that certain traits and anomalies of the primary occlusion are often reflected or worsened in the permanent dentition.[1,7–9] Therefore, the primary dentition is believed to provide the basis for studying occlusion and for predicting the occlusion of the permanent dentition.

Relatively recently there were some reports on the occlusion of the pre-primary Nigerian school children, aged 3–5 years, which have provided some information on the pattern of occlusion in the primary dentition in the country.[10–15] Nigeria being a large multi-ethnic nation, the last reports attempted to assess any possible ethnic variations in the occlusion of the preschool children.[14,15]

Just like in other countries, the philosophy of early orthodontic treatment and preventive and interceptive orthodontics is advocated in Nigeria.[13,16–21] This treatment philosophy is more needful considering the high poverty level in a developing economy like Nigeria and the high cost of comprehensive orthodontic treatment. According to Bishara et al,[1] an understanding of the anteroposterior changes that occur in the occlusion between the deciduous and permanent dentition is crucial for the clinician involved in early orthodontic treatment. While there are studies from other parts of the globe in relation to growth and development of the occlusion,[22–29] there is no such report so far from Nigeria.

Therefore, the purpose of this longitudinal pilot study was to evaluate the changes in occlusion of a group of Nigerian children from the deciduous to the early mixed dentition stages of occlusal development.

MATERIALS AND METHODS Return to TOC

The material for this follow-up investigation was obtained from a pre-primary school center of a popular nursery and primary school near the Dental Center/ Faculty of Dentistry, College of Medicine, University of Ibadan, Ibadan, Nigeria. The center is attended by pre-primary and primary school children from various parts of Ibadan City. Ibadan is a city in the southwest part of Nigeria and the largest city in the whole of the southern Sahara. Outside the Yoruba ethnic group, the city plays host to other Nigerians from virtually all parts of the country.

After obtaining permission from the Oyo State Ministry of Education and the management of the center to carry out the study in October 2002, initially 145 pre-primary school Nigerian children comprising 62 boys and 83 girls aged 3–5 years were examined. They were all examined in their school premises under natural illumination, using the criteria of Foster and Hamilton[30] to assess the anteroposterior relationship of the second deciduous molars and other occlusal features. Other occlusal variables assessed were spacing in the arches, crowding, overjet, overbite, and oral habits. The presence of other anomalies recorded included scissors bite, crossbite, anterior open bite, trauma to teeth, double teeth, and carious teeth. The names, ages, and gender of the children were recorded during the examination.

Of the 145 subjects initially evaluated during the primary dentition stage (Time 1), only 61 subjects were located and reexamined 4 years later (October 2006) in the primary school classes of the same center (Time 2). Seven of the 61 subjects were excluded in the final study sample because their first permanent molars were not yet fully erupted. The rest of the initial 145 subjects could not be located as some of the families had relocated to other parts of the country or outside the country. Some of the children had gone to other primary schools in the city and other parts of the country, and the school authority could not identify the schools.

In the final study sample none of the 54 subjects (26 male and 28 female) had any congenitally missing teeth at both examination times; none of them had any history of early loss of second deciduous molar and none experienced any form of dental treatment including orthodontic care.

The anteroposterior relationship of the arches was recorded at the second examination (Time 2) based on the Angle criteria.[31] Other occlusal variables examined included spacing, crowding, overbite, overjet, oral habits, and other anomalies as recorded during the first examination (Time 1). More details about the criteria for the occlusal parameters assessed at Time 1 and Time 2 in this study are available in other reports.[12,30,32]

In this paper, only the initial anteroposterior relationships of the second deciduous molars of the final study sample, occlusal changes between the first time (Time 1) and the second time (Time 2) including molar relationships, overjet, crowding, and spacing variables are reported.

Intra-examiner Reliability Test

Very good intra-examiner reliabilities of the same examiner (Dr Onyeaso) on the assessments of these occlusal features have been reported earlier.[13,32]

Statistical Analyses

Descriptive statistics including frequency and percentage distribution of variables were calculated at the two examinations. Then chi-square test was used to determine whether significant gender differences were present, and significance was predetermined at the 0.05 level of confidence. Pearson correlation coefficients (*r*) were calculated to determine associations between changes in molar relationships, overjet, overbite, crowding, and spacing features of the initial and final occlusions of the subjects.

RESULTS Return to TOC

The second deciduous molar relationships of the final study sample at the time of initial examination (Time 1) are shown in Table 1. Changes in molar relationship from the deciduous to the early mixed dentitions in the final study sample are shown in Table 2. Twenty-two (68.7%) of 32 subjects initially having a flush terminal plane relationship resulted in a Class I molar relationship. Eleven (61.1%) of 18 subjects who initially had a Class III (mesial step) relationship of the second deciduous molars became a Class I molar relationship while five (27.8%) resulted in a Class III relationship.

Table 3 shows the age and gender distribution of the Angle classification of the final study sample. Significantly more male subjects had a Class I molar relationship at age 8, but female subjects at the age of 9 ($P < .05$).

The overbite pattern of the subjects at Time 1 and Time 2 is shown in Table 4 with a majority of subjects maintaining normal overbite at both stages of occlusal development. Table 5 gives the overjet pattern of the same subjects at the different stages of occlusal development with normal overjet having the highest proportions—43 (79.6%) and 36 (66.7%) at Times 1 and 2, respectively.

Table 6 shows the correlations of the occlusal traits at the two stages of occlusal development, according to Pearson correlation coefficient with three of them (overjet, overbite, and crowding) giving positively significant correlations ($r = .357$, $P = .008$; $r = .428$, $P = .001$; and r .601, $P = .000$), respectively, while generalized spacing of the anterior segments in the deciduous dentition (Time 1) and corresponding spacing in the same regions in the early permanent set (Time 2) did not ($r = .245$, $P = .074$). All the correlations for the occlusal variables were lower than 0.7.

DISCUSSION Return to TOC

According to Bishara et al,[1] the final molar occlusion is dependent on a number of dental and facial skeletal changes, both genetic and environmental, that interact to achieve, or not achieve normal occlusion.

The distribution of Angle molar classification and other occlusal variables in this study that resulted from the time of initial examination (Time 1) is consistent with earlier reports in epidemiological and clinical studies among Nigerians.[2,3,4,32,33] The findings in this present investigation indicated that if the initial occlusion in the primary dentition is a flush terminal plane (Class I) or mesial step (Class II), a majority of the subjects will develop into Angle Class I in the permanent dentition. This is consistent with the findings of Bishara et al.[1] Meanwhile, the only subject in this study initially having distal step relationship of the second deciduous molars resulted in a normal Angle Class I molar relationship. This observation deserves a good follow-up of the subject to complete the permanent dentition so as to ascertain any possible change of this molar relationship into a Class II relationship. It is generally accepted the distal step relationship of the second deciduous molars usually results in a distocclusion (Class II) molar relationship in the permanent dentition.[1,7–9]

There was no consistent gender difference observed in the permanent molar relationship in this study. Again, this is consistent with previous studies in Nigerian

children showing no defined gender bias for the molar occlusions.[2,3,32–34]

Overbite and overjet patterns of the subjects at the two periods of examination are consistent with Nigerian literature on occlusions in the deciduous and permanent dentitions.[4,12,14,15] In the present study, only one of the occlusal variables (spacing of the arches) did not correlate positively between the primary and early mixed dentition stages. This could be due to the fact that the generalized spaces recorded in the deciduous (primary) dentitions were utilized for the eruption of the larger permanent incisors in the early mixed dentition.

While it should be noted that the changes in the other four occlusal features were significantly positively correlated, it is worth noting also that all the positively significant correlations (*r*) were below 0.7. One of the main purposes of correlating the variables between the deciduous and early mixed dentition stages is to possibly predict the occlusion in the permanent dentition. Correlations below 0.7 or $r = 0.8$ do not give an accurate prediction for individuals.[24] Therefore, although these correlations in this Nigerian study are significant and could be a guide, they do not guarantee an accurate prediction of the occlusal features in the permanent dentition. The current finding is in agreement with the findings of Bishara et al.[1,24]

A follow-up of these subjects is being planned to ascertain their definitive occlusal status in the full permanent dentition stage when the children would have been in secondary school. The idea of having at least one Growth and Development Study Center in Nigeria is to be advocated as this will help in having more longitudinal studies that can also guarantee larger sample sizes.

CONCLUSIONS Return to TOC

- The establishment of a Class I molar relationship is favored more by a flush terminal plane (Class I) and mesial step (Class III) relationships of the second deciduous molars.
- All occlusal features studied had significant positive correlations between the primary and the early mixed dentition stages with crowding having the highest value, except generalized spacing in the anterior segments in the primary dentition and corresponding spacing in the same regions in the early mixed dentition.
- Although significant correlations were found for most of the occlusal features between the two stages of occlusal development, all were below 0.7 values. This could be suggestive of a poor predictive power of these variables from the occlusal features in the primary (deciduous) dentition.

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TABLES Return to TOC

Table 1. Occlusal (Anteroposterior) Relationships of the Second Deciduous Molars of the Subjects at the Time of First Examination (Time 1)[a]

	Gender					
	Male		Female		Total	
Molar Relationship	n	(%)	n	(%)	n	(%)
Class 1 (Flush terminal plane relationship)	15	(46.9)	17	(53.1)	32	(59.3)
Class 2 (Distal step)	—	—	1	(100)	1	(1.8)
Class 3 (Mesial step)	10	(55.6)	8	(44.4)	18	(33.3)
Asymmetric relationships (Right and left sides of the arches)	1	(33.3)	2	(66.7)	3	(5.6)
Total	26	(48.1)	28	(51.9)	54	(100)

[a] $X^2 = 1.609$; df = 3; $P = .657$.

Table 2. Occlusal (Anteroposterior) Changes From the Initial Deciduous Molar Relationships (Time 1) to the Present Permanent Molar Relationships (Time 2)

Initial Deciduous Molar Relationships (According to Foster and Hamilton[30])	Present Permanent Molar Relationships (Angle Classification)							
	Class I		Class II		Class III		Asymmetric Relationship (Right and Left)	
	N	(%)	n	(%)	n	(%)	n	(%)
Class 1 (Flush terminal plane, n = 32)	22	(68.7)	7	(21.9)	—	—	3	(9.4)*
Class 2 (Distal step, n = 1)	1	(100)	—	—	—	—	—	—
Class 3 (Mesial step, n = 18)	11	(61.1)	1	(5.6)	5	(27.8)	1	(5.6)***
**Asymmetric (left and right sides, n =3)	3	(100)	—	—	—	—	—	—
Total	37	(68.5)	8	(14.8)	5	(9.3)	4	(7.4)

* All three subjects with asymmetric Angle classification resulting from initial Class 1 (flush terminal plane) had Class II on one side and Class I on the other.

** All three subjects with initial asymmetric relationships in the deciduous dentition that resulted in Angle Class I relationship had Class III (mesial step) on one side and Class I (flush terminal plane) on the other.

*** The only subject with initial symmetric Class II (mesial step) relationship which did not result into symmetric Angle classification had Angle Class I on the left side and scissors bite on the right side.

Table 3. Age and Gender Distribution of the Angle Classification of the Children[a]

Anteroposterior Molar Relationship (Angle Classification)	Age (Year) and Gender															
	7[a]				8[b]				9[c]				Total			
	M		F		M		F		M		F		M		F	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Class I	12	(32.4)	10	(27.0)	9	(24.3)	3	(8.1)	—	—	3	(8.1)	21	(56.8)	16	(43.2)
Class II	—	—	2	(25)	—	—	5	(62.5)	1	(12.5)	—	—	1	(12.5)	7	(87.5)
Class III	2	(40)	2	(40)	—	—	1	(20)	—	—	—	—	2	(40)	3	(60)
Asymmetric relationships (right and left)	—	—	1	(25)	1	(25)	2	(50)	—	—	—	—	1	(25)	3	(75)
Total	14	(48.3)	15	(51.7)	10	(47.6)	11	(52.4)	1	(25)	3	(75)	25	(46.3)	29	(53.7)

[a] At age 7: $X^2 = 3.151$; df = 3; $P = 0.369$.
[b] At age 8: $X^2 = 9.000$; df = 3; $P = 0.029$ (significantly more male patients had class I molar relationship at age 8).
[c] At age 9: $X^2 = 4.000$; df = 1; $P = 0.046$ (significantly more female patients had class I at age 9).

Table 4. Overbite Pattern of the Subjects at Time 1 and Time 2 of the Occlusal Development[a]

Time 1			Time 2		
Overbite	Frequency	(%)	Overbite	Frequency	(%)
Normal	42	77.8	Normal	34	63
Increased	1	1.8	Increased	2	3.7
Reversed	6	11.1	Reversed	1	1.8
Reduced	—	—	Reduced	3	5.6
AOB	3	5.6	AOB	10	18.5
E-to-E bite	2	3.7	E-to-E bite	2	3.7
			Incomplete	2	3.7

[a] AOB indicates anterior openbite; E-to-E bite, edge to edge bite.

Table 5. Overjet Pattern of the Subjects at Time 1 and Time 2 of the Occlusal Development [a]

Time 1			Time 2		
Overbite	Frequency, %		Overbite	Frequency, %	
Normal	43	79.6	Normal	36	66.7
Increased	—	—	Increased	5	9.3
Reversed	6	11.1	Reversed	1	1.8
AOB	3	5.6	AOB	10	18.5
E to E bite	2	3.7	E to E bite	2	3.7

[a] AOB indicates anterior openbite; E-to-E bite, edge to edge bite.

Table 6. Correlation Coefficient (*r*) Between the Occlusal Traits at Time 1 and Time 2 of Examinations of the Subjects

	Time 2				
Time 1	Overjet	Overbite	Crowding	Spacing	First Permanent Molar
Overjet	.357**				
Overbite		.428**			
Crowding			.601**		
Spacing				.245	
Second deciduous molar relationship					.492**

** Correlation is significant at the 0.01 level (2-tailed).

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